CHAPTER 6
AIR DRYER

6-1. Application.

Some compressed air applications require moisture removal in addition to that provided by an aftercooler. Such applications include paint spraying, sandblasting, use of air-operated tools and devices, pneumatic automatic temperature controls, lines run outside in cold or subfreezing locations, and lines passing through cold storage rooms.

6-2. Dryer types.

Supplementary moisture removal requires additional equipment, higher first cost, and higher operating cost for all drying methods. In determining overall costs, the initial purchase price should be weighed against operating and maintenance costs. Figure 6-I illustrates the relative costs for the various types of dryers, and presents selection guidelines. In determining the type of dryer to be used for a given application, drying requirements, flow, pressure, inlet temperatures, and the pressure dew point must be accurately determined. The dryer that meets these requirements most economically and efficiently should be selected. The various drying methods are as follows:

a. Refrigeration. Refrigeration dryers remove moisture from compressed air by cooling the air in a heat exchanger. This condenses and removes the moisture from the airstream and produces an operating pressure dew point at the dryer outlet in the range of 35 to 39 degrees F. By adjusting the refrigeration unit operating parameters, these units can produce pressure dew points of 50 degrees F. Higher dew points are available in either direct refrigeration or chiller-type design.

b. Twin-tower regenerative. Regenerative dryers utilize nonconsumable desiccants to remove moisture from compressed air. Inlet air is automatically cycled between two desiccant towers, one absorbing moisture from the inlet air while the other is being regenerated. This method of regeneration includes the following dryer classifications:

(1) Heatless desiccant regeneration passes a quantity of dried (purge) air through the offstream bed. No external heat is applied. This type, with a field-adjustable purge control should be selected so that purge rate (and therefor pressure dew point) can be adjusted to accomodate seasonal variations in ambient temperatures, thereby reducing operating costs. Heatless dryers are capable of providing minus 150 degrees F, pressure dew point. Maintenance costs are low since there are few' moving parts. With adequate prefiltering to remove oil, desiccant replacement requirements are minimal.

(2) Heat regenerative dryers utilize heat from an external source (either electric or steam) in conjunction with purge air to regenerate the offstream tower. By reducing the amount of purge air required for regeneration, the heat regenerative dryer operating costs are lower. High regenerative temperatures, however, are damaging to equipment and desiccant, so any savings in operating costs can be outweighed by the costs of maintenance and downtime.

c. Deliquescent. Deliquescent (salt pellet) dryers and ethylene glycol stills are included in this manual for comparison and general information purposes only, and will not be used because of their high operating cost and their limited effect on pressure dew point. These types of dryers carry over salt or glycol into the airlines, resulting in corrosion and potential damage to controls and tools. Glycol also reacts with certain constituents of the air (mainly carbon dioxide and carbon monoxide) to form corrosive compounds that attack piping and equipment.

6.3. Prefilters and afterfilters.

Consideration should be given to providing a prefilter upstream of the air dryer and an afterfilter downstream of the air dryer. A prefilter may be required to remove compressor carry-over oil and other undesirable particles from the air prior to the air entering the air dryer. This filter can extend the life of the air dryer and reduce air dryer maintenance costs. An afterfilter should be considered to protect the downstream piping system and equipment from impurities and undesirable particles added to the air as a result of passing through the air dryer. Air dryer manufacturers should be consulted for recommendations and selection of prefilters and after filters for specific air quality requirements.

Type of Dryer	Pressure Dew Point Range	Typical Applications	Initial Cost	Operating Cost	Remarks
DELIQUESCENT					
	12-20°F below inlet temperature	Protection against condensation in indoor air lines.	Lowest	Low to moderate	Causes high maintenance of downstream equipment due to salt solution in air lines.
REFRIGERATED					
	Above 33° F	General plant air, air-operated tools, instruments; materials conveying.	Low	Lowest	Most widely used type of air dryer because of its inherent reliability and low cost factor.
TWIN-TOWER REGENERATIVE					
Heatless Desiccant	Below 33°F (down to minus 150°F)	Outside air lines; chlorine padding; manufacturing processes requiring very dry air such as assembling electronic components and making urethane foam.	Low to moderate	Highest	Inefficient operation due to high purge rate.
Heat Regenerative			Moderate to high	Moderate to high	Minimum air waste for high flow, low dew point applications.

Reprinted with permission of Deltech Engineering Inc.,
Century Park, New Castle, Delaware

Figure 6-1 Selection guidelines for compressed air dryers.